Evaluation of Utility Integration Capacity Analyses (ICAs)

ICA Workshop– November 10, 2015

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ORA's Objectives Regarding DRPs

- CPUC and state policies correctly implemented

- Avoid artificial barriers to distributed energy resource (DER) interconnection –(ICA specific)

- Avoid unreasonable ratepayer expenditures for distribution infrastructure upgrades

- Realize maximum ratepayer savings for distributed resource plan (DRP) investments

ORA Discovery

- First phase of data requests (DR) to PG&E only
- Six DRs related to DRPs, existing assets/facilities, distribution planning, and 43 questions focused on ICA:
  - PG&E's responses generally very helpful in building a better understanding of its ICA
  - PG&E labeled three responses and one attachment labeled Confidential
  - Remaining questions to be addressed through meeting
- ORA can provide copies of <u>questions</u> to parties, but <u>responses</u> should be obtained through PG&E

ORA Results to Date

- Responses to DR questions synthesized into DRAFT flow charts of PG&E ICA process

- List of ICA effectiveness criteria

- Keys to accurate results

- Catalog of open questions
  - Some we hope to discuss today
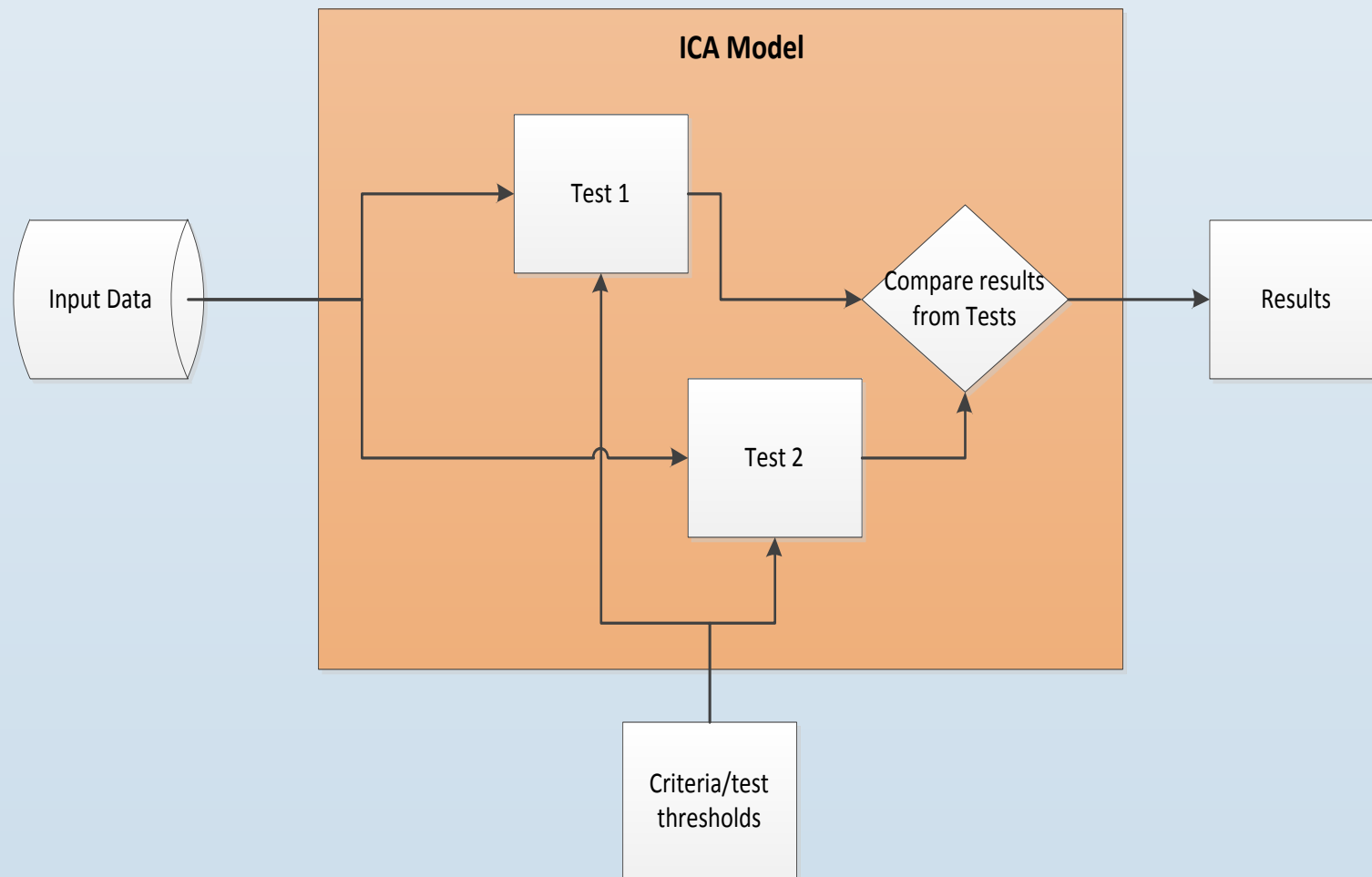 - Most we plan to discuss with PG&E directly
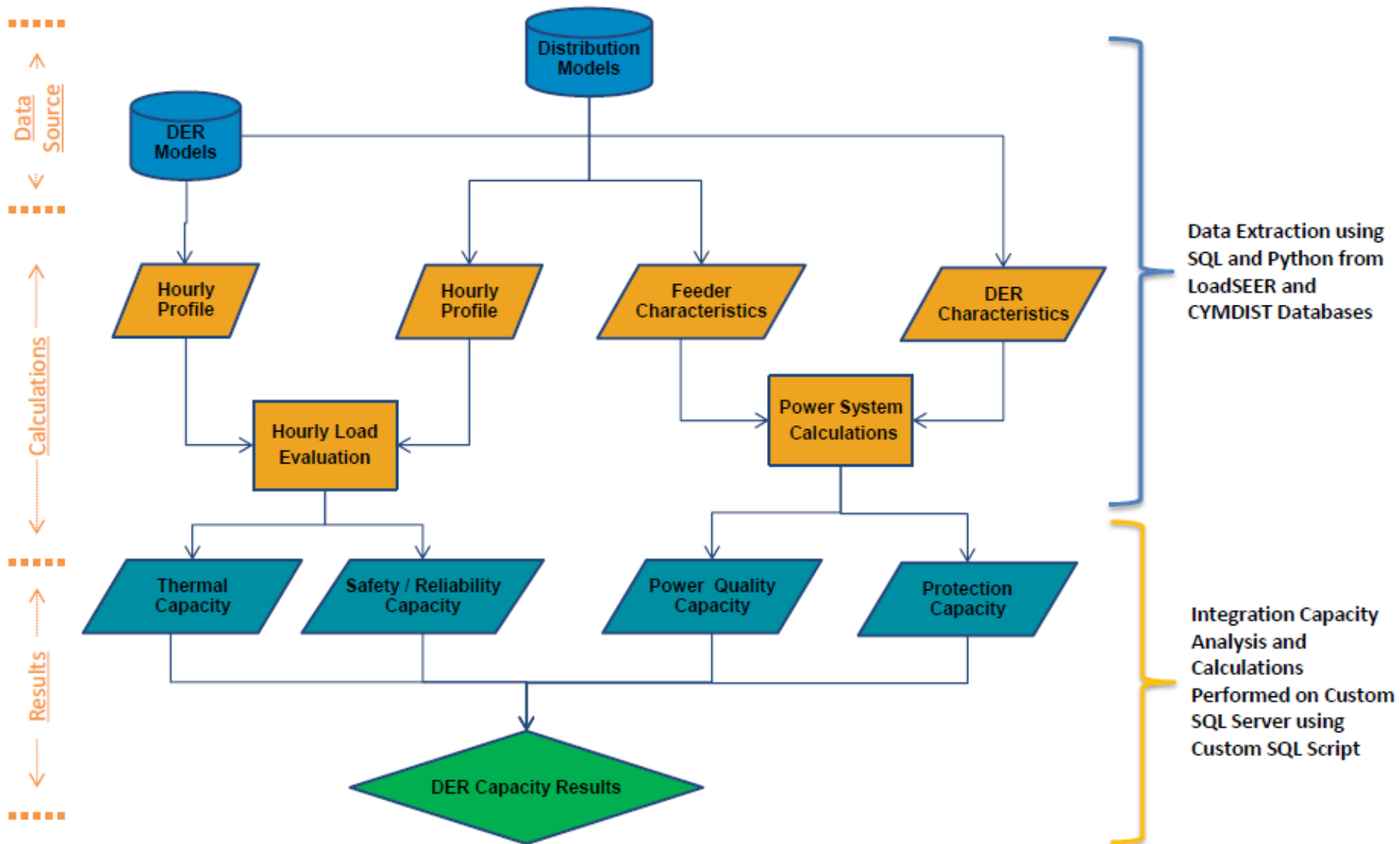
ORA Flowcharts of PG&E ICA

- Deemed necessary based on ORA experience with PG&E gas pipelines, post-San Bruno

- Work in progress, **<u>NOT</u>** vetted by PG&E

- These drafts intended as a strawman to:

  - Help parties and CPUC staff understand ICA data sources, process, tests, and all tools

  - Provide an outline for PG&E to correct and flesh out

General ICA Methodology - Simplified

ICA Model

Input Data → Test 1, Test 2 → Compare results from Tests → Results

Criteria/test thresholds

PG&E ICA Flow Chart

Source: Slide 23 of attachment to PG&E response to DR-ORA-004-Q8

PG&E ICA Methodology -Simplified

Source: ORA DRAFT
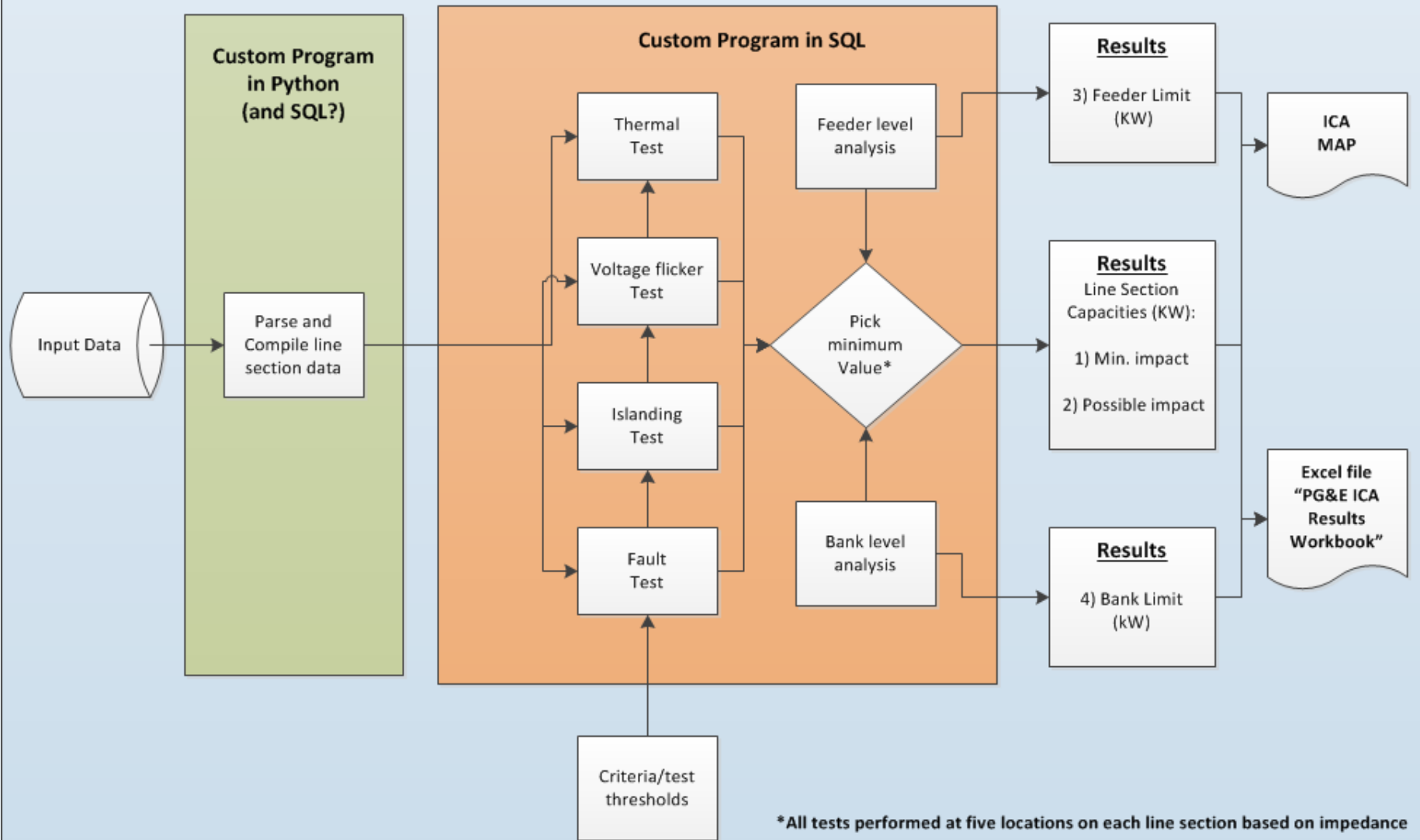
PG&E ICA Tests and Criteria

- ## Thermal test
  - kW limit =
  $$Min\left(\frac{Capability - Gen_{FDR}[mn][hr] + Load_{FDR}[mn][hr]}{DER_{pu}[mh][hr]}\right)$$

- ## Voltage test
  - kW limit =
  $$\frac{(3\% * V_{LL}^2)}{(R * PF_{DER} + X * \sin(\cos^{-1}(PF_{DER})))} * PF_{DER}$$

- ## Islanding test
  - kW limit =
  $$= Min\left(Max\left(\left[\frac{Load[mn][hr] * 0.5}{DERpu[mh][hr]}\right], \left[\frac{DG_{existing}[mn][hr] \div RatioThreshold}{DERpu[mh][hr]}\right]\right)\right)$$

- ## Fault test
  - kW limit =
  $$\frac{10\% * I_{Fault\ Duty} * kV_{LL} * \sqrt{3}}{\left(\frac{Fault\ Current_{DER}}{Rated\ Current_{DER}}\right)} * PF_{DER}$$

PG&E ICA Methodology – Part 1

Custom Program in SQL

Input Variables											Criteria	Test
Equipment Termal Limits	Load - level and profile	New DER - level and profile	Existing DER - level and profile	"Ratio Threshold "	VLL	"R"	DER Power Factor	"X"	Fault duty current	DER fault current	DER rated current	
X	X	X										100%	Thermal Limit
					X	X	X	X				3%	Flicker Limit
X	X		X	X								50%	Islanding Limit
					X		X		X	X	X	10%	Protection Limit

Feeder level analysis

Results

3) Feeder Limit (KW)

Pick minimum Value*

Results

Line Section Capacities (KW):

1) Min. impact

2) Possible impact

Bank level analysis
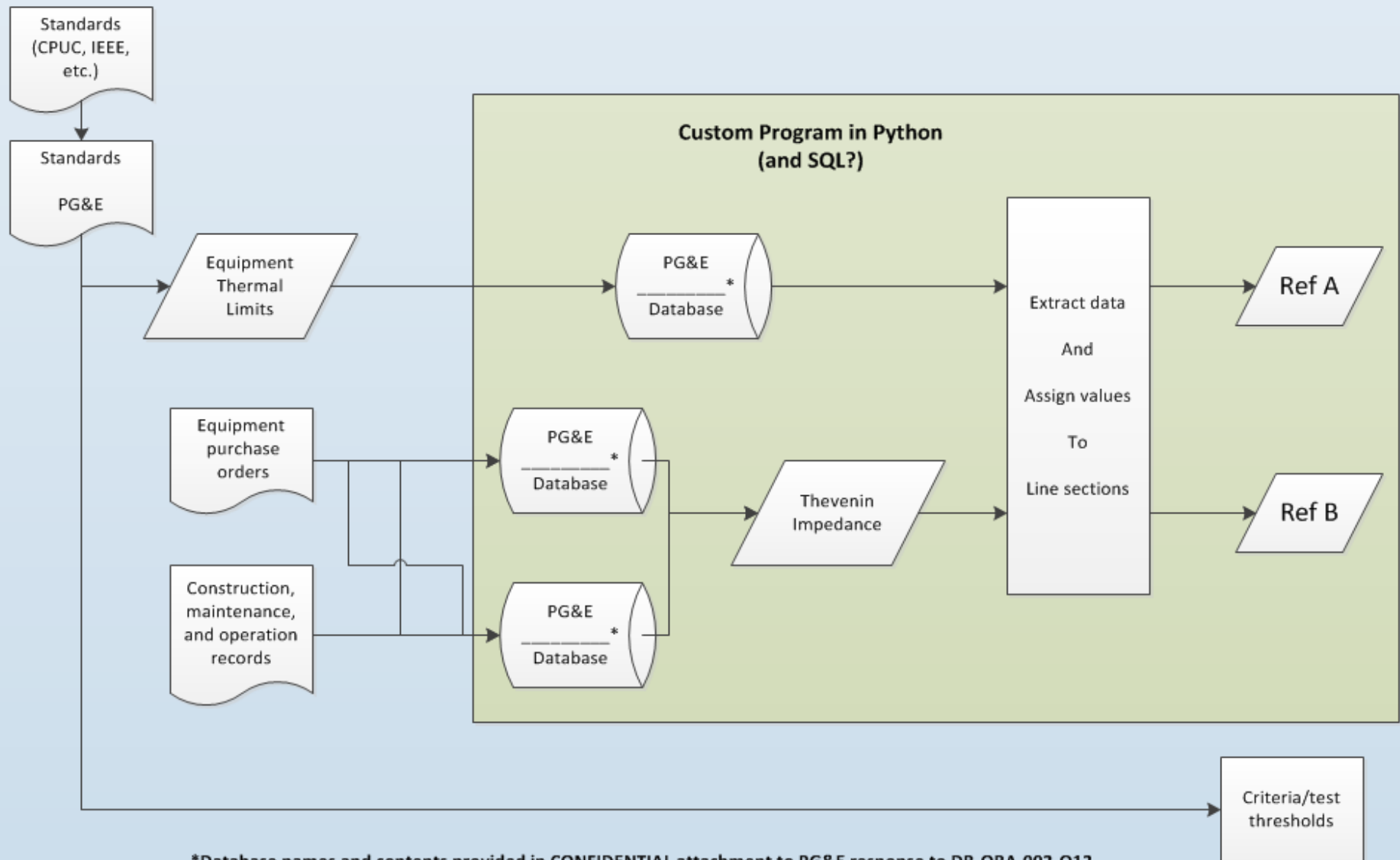
Results

4) Bank Limit (kW)

Ref A

Ref B

Criteria/test thresholds

*All tests performed at five locations on each line section based on impedance

Source: ORA DRAFT

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PG&E ICA Methodology – Part 2

*Database names and contents provided in CONFIDENTIAL attachment to PG&E response to DR-ORA-002-Q12

ICA Effectiveness Criteria, Part 1of 2

1. Accurate and meaningful results – details on Slide 14
2. Transparent methodology
3. Uniform process that is consistently applied
4. Complete coverage of service territory
5. Useful formats for results
6. Consistent with industry, state, and federal standards

ICA Effectiveness Criteria, Part 2 of 2

7. Accommodates portfolios of DER on one feeder
8. Reasonable resolution
    – Spatial
    – Temporal
9. Easy to update based on improved and approved changes in methodology
10. Easy to update based on changes in inputs (loads, DER portfolio, DER penetration, circuit changes, assumptions, etc.)
11. Consistent methodologies across large IOUs
12. Methodology accommodates variations in local distribution system, such that case by case or distribution planning area (DPA) specific modifications are <u>not</u> needed

Keys to Accurate and Meaningful Results

A. Meaningful scenarios

B. Reasonable technology assumptions

C. Accurate inputs (i.e. load and DER profiles)

D. Reasonable tests (i.e. voltage flicker)

E. Reasonable test criteria (i.e. 3% flicker allowed)

F. Tests and analysis performed consistently using proven tools, or vetted methodology

G. Meaningful result metrics provided in useful formats

Preliminary Observations

- Limiting scope to 3-phase circuits leaves out a large portion of feeders (49% based on mileage, 63% based on customers)

- Automating tests via script/codes helps ensure consistency, but full vetting and QA/QC is required

- Granularity of analysis is currently limited by aggregate customer class load profiles

- Test/criteria (thermal vs. flicker) driving IC for each line segment is not currently available

Preliminary Conclusions

- Each IOU should provide full documentation of entire ICA methodology and QA/QC procedures to all parties, including flowcharts of entire methodology

- Parties and CPUC staff should be allowed time to review these additional details before a determination of ICA adequacy and consistency is made

- ORA looks forward to working with utilities to fully understand the ICAs, and working with CPUC staff and parties to help ensure the ICAs meet consensus effectiveness criteria